There has recently been concern about carcinogens in drinking water.

**ASBESTOS**

In Duluth, Minnesota, asbestos in substantial amounts has been found in the water supply, which has apparently been contaminated since 1955 with industrial waste from taconite ore discharged into Lake Superior. Asbestos, when inhaled, is known to be carcinogenic in man. It causes pleural and peritoneal mesothelioma, lung cancer, and gastrointestinal neoplasia in factory workers exposed to the fibers, and mesothelioma of the pleura or peritoneum among persons living in the neighborhoods of these factories and perhaps in the households of workers. An increase in the frequency of bronchogenic carcinoma has also been reported among persons with low-level (nonoccupational) exposures to asbestos.

Asbestos is believed to be carcinogenic because of its physical rather than its chemical properties—specifically, the length and diameter of the fibers are related to their carcinogenicity in rats. Long thin fibers seem to be more harmful than short thick ones, but short fibers cannot yet be regarded as harmless. Millions of asbestos fibers are found per liter of water drawn from the taps in Duluth. Most are of short length, less than 5 μ. Studies of cancer mortality through 1971 showed no increase that was attributable to contamination of the water supply, but the latent period for asbestos-induced cancer is known to be two or more decades, well beyond the interval for which data were available.

The problem, if indeed there is one, may not be limited to Duluth, since other water supplies contain asbestos fibers leached from serpentine-or amphibole-rock or from asbestos-containing cement pipes. This water contains 0.1 to 3.9 million fibers of asbestos per liter (mfpl), a lower range than that found in unfiltered drinking water in Duluth (1 to 30 mfpl). Levels of 2 to 12 mfpl were found in beer, sherry, port wine, vermouth, and soft drinks, apparently from asbestos used in the filtration process.

An Advisory Committee on Asbestos convened by the International Agency for Research on Cancer in October 1972 concluded that there was no evidence that asbestos in water, beverages, food, or parenteral fluids increased the risk of cancer. In July 1974, the same conclusion was reached by an expert Committee of the American Water Works Association Research Foundation. This report, issued after the Duluth situation came to public notice, did not refer to it, probably because the data then available were insufficient.

Both reports pointed out that in animal experimentation ingested asbestos fibers have not produced cancer, but there appears to be no
doubt that there is an increased frequency of human gastrointestinal cancer after occupational exposures—presumably from asbestos that has been swallowed. When peritoneal mesothelioma is induced, the pathway taken by the asbestos is unknown. It might be through the lungs and/or the gastrointestinal tract.

**CHEMICAL CARCINOGENS**

In June 1974 Harris and Brecher began a three-part serial in *Consumer Reports* that called public attention to impurities in various water supplies of the United States. The presence of chemical carcinogens was mentioned prominently, especially with regard to New Orleans. In an unpublished report issued two years earlier by the Environmental Protection Agency (EPA), waste waters from 60 industries discharging into the Mississippi River were described as having high concentrations of organic chemicals and toxic metals. Municipal water supplies contained organic chemicals believed to be responsible for the objectionable flavor of drinking water and fish flesh. The contamination, it was said, “may represent a potential threat to the health and well-being of the consumers.”

The drinking water in New Orleans and adjacent areas comes from the Mississippi River, and contains small amounts of chlorinated or brominated hydrocarbons, perhaps from waste material discharged by petroleum or chemical factories upriver, from agricultural runoff, or from local water treatment plants. Some of the contaminants are known to induce cancer in experimental animals. Because halogenated hydrocarbons are lipophilic, they tend to accumulate in blood and adipose tissues.

In a widely publicized but as yet unpublished report issued by Harris on November 6, 1974, accompanied by a statistical analysis by Page and Harris, it was claimed that the high total cancer mortality among whites in the New Orleans area was due to carcinogens in the drinking water. The report failed to note that the elevation in rates was due mainly to lung cancer, that there was no comparable effect in white females, and that not all counties using the same water supply showed the same effect, although the same sex differences occurred in many other cities—even when their water supplies were purer than that of New Orleans. For almost three decades it had been known that the rates for urinary bladder cancer in the area had been high, particularly in males. The likely explanation for the high rates of lung cancer in males but not in females in New Orleans, as elsewhere, is not from water which everyone drinks, but from other exposures which are sex-specific, such as occupation.

In any event, the Duluth experience and the reports by Harris and Brecher stimulated Congress to pass a Safe Drinking Water Act on December 16, 1974. An amendment to the Act directs the Administrator of the Environmental Protection Agency to make a “comprehensive study of public water supplies . . . to determine the nature, extent, sources and means of control of contamination by chemicals or other substances suspected of being carcinogenic.” An interim report was required by mid-June 1975 and a detailed account before the end of the year.

The EPA has prepared a list of 221 organic compounds identified in drinking water in the United States as of June 1, 1975. Among them are vinyl chloride, pesticides, and polycyclic hydrocarbons—compounds which in occupational exposures have been harmful to man. In addition the EPA has reported that lead in tap-water exceeded the 1962 Public Health Service Water Standard in 65% of the homes surveyed in Boston and 25% of those in Seattle.

In a study by the EPA of six organic chemicals of particular concern, it was found that chlorination contributed to the formation of four: chloroform, bromoform, bromodichloromethane, and dichloromethane. In finished (i.e., treated) water, the concentration of chloroform ranged from 0.1 µg to 311 µg/liter. In addition to the effects of individual compounds, the possibility of interactions must be considered.

With regard to the health risk from organics in drinking water, an expert study group of the EPA deemed chloroform to be most suspect as a potential human carcinogen because it induces liver tumors in mice. There is no epidemiologic evidence of its carcinogenicity in man, it was noted, and definitive studies have yet to be made. Although certain other contaminants evaluated by the study group were thought to have carcinogenic potential, the risk in man, if any, was thought to be minor because of the low concentrations and infrequent occurrence of these chemicals in drinking water.

**PEDIATRIC IMPLICATIONS**

The fetus and child may be more susceptible than the adult to the effects of chemical pollutants, and long life-expectancy may allow accumulation of sufficient doses and survival through extended latent periods. There is at present, however, no basis for recommending a change in water supply because of potential carcinogens.
To pediatricians, contamination of tap-water with lead in some cities will be a more realistic concern than are small amounts of chemicals whose carcinogenicity in man is unknown.

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**REFERENCES**

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Robert W. Miller
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